THE NATURE OF THE BACTERIAL SURFACE

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Edited by
A. A. MILES and N. W. PIRIE

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PREFACE

SOMETHING of the nature of the bacterial cell has been known for as long as bacteria themselves have been studied. Gross characters like spores, capsules, granules and flagella were recognized, but it is only in recent years that the finer structure and still more the extraordinary enzymic activity of these minute bodies has attracted the general attention of microbiologists.

The fact that bacteria are so small makes the surface phenomena of particularly great importance. On April 20, 1949, the Society for General Microbiology accordingly held a symposium in London at which chemists, physicists and biologists expressed their views on certain aspects of 'The Nature of the Bacterial Surface'.

The Society took the opportunity of inviting certain distinguished workers from France, Holland, South Africa and the United States of America and is grateful to these scientists for the help they gave in making the symposium a success.

The proceedings are set forth in this volume and, though it is not a complete account of everything that happens on the bacterial surface, some of the more important problems are discussed.

It is hoped that the reader will derive some benefit or get some new idea by a study of the various views expressed.

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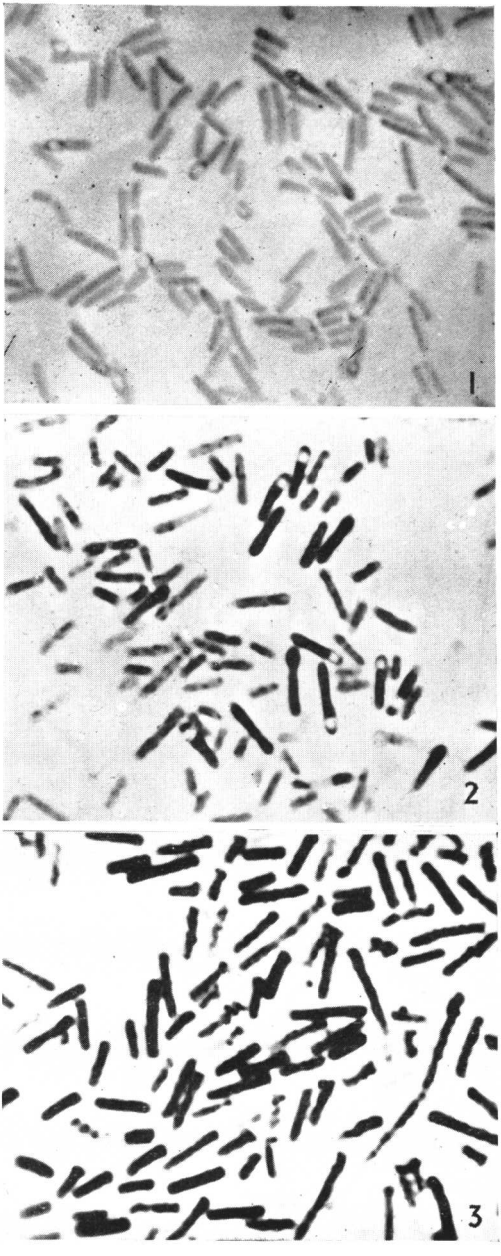

PLATE 1.

Fig. 1. Gram-negative forms of *Cl. sporogenes*. Fig. 2. *Cl. sporogenes* 'replated' with magnesium ribonucleate. Fig. 3. *Cl. welchii* cells stripped with bile salt and replated with magnesium ribonucleate. End-to-end coupling of the cells has occurred. Photographed by Dr. H. Henry. (M. Stacey.)

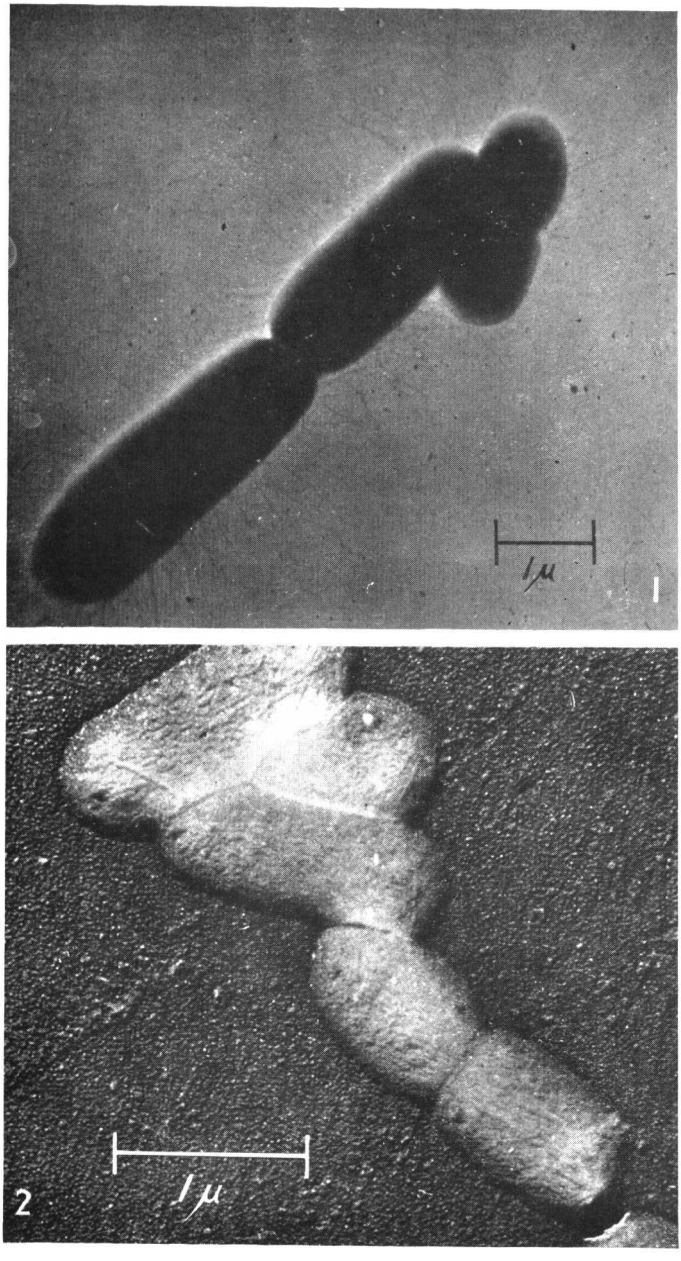

PLATE 2.

Fig. 1. *Escherichia coli* strain B grown on the supporting collodion membrane as seen in the electron miscroscope, showing tenuous threads of capsular material radiating from cells, the cell walls and the outlines of the cytoplasm. Fig. 2. *Escherichia coli* strain B shadowcast with gold. The surfaces of the cells seem to be covered with fuzzy layers of material. (Dr. T. F. Anderson.)

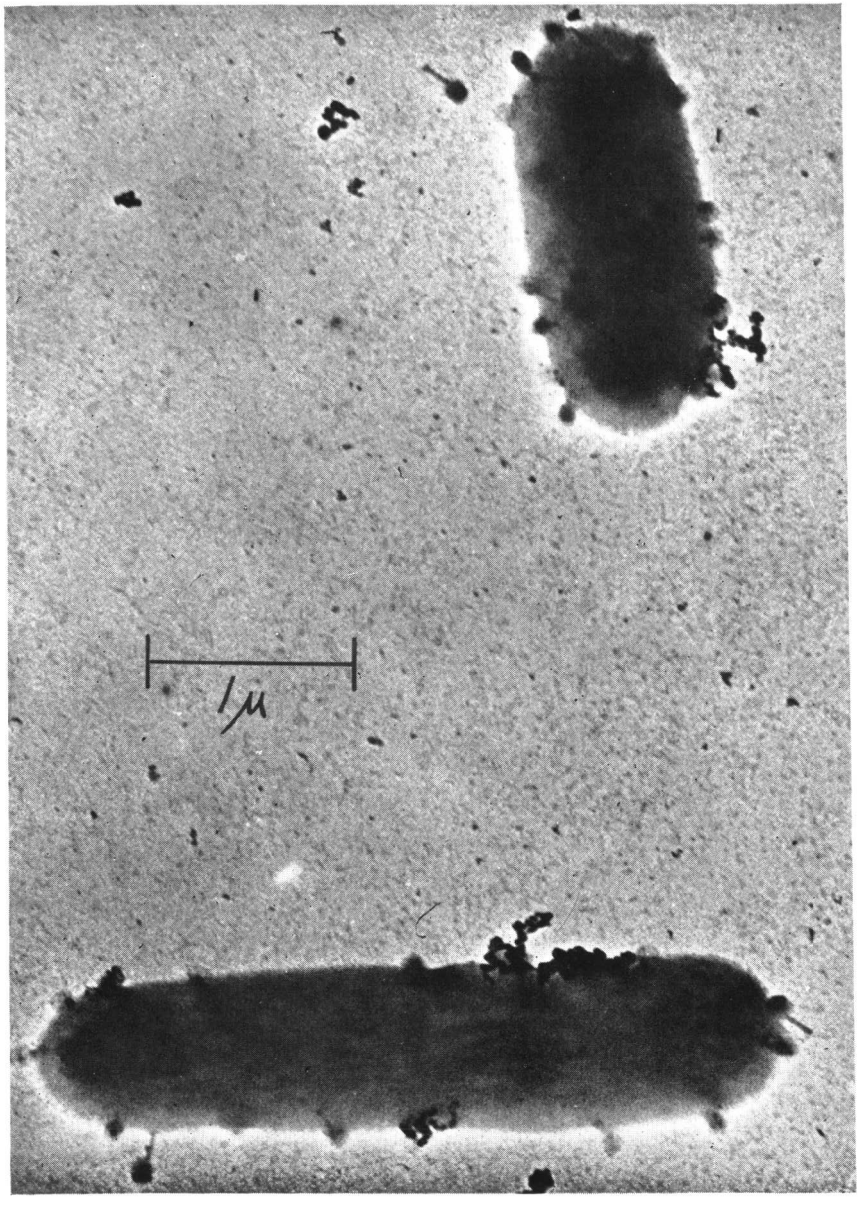

PLATE 3.

A mixture of *Escherichia coli* strain B and tryptophan-activated *T* 4. To 0·9 ml. of ammonium lactate medium containing about 10^9 cells were added 0·05 ml. of *T* 4 ($2{\cdot}5 \times 10^{11}$ per ml.) and 0·1 mg. of L-tryptophan in 0·1 ml. of ammonium lactate. Thirty seconds later the mixture was mounted for study in the electron microscope. Progressive stages in the adsorption of the tadpole-shaped virus particles can be seen. (Dr. T. F. Anderson.)

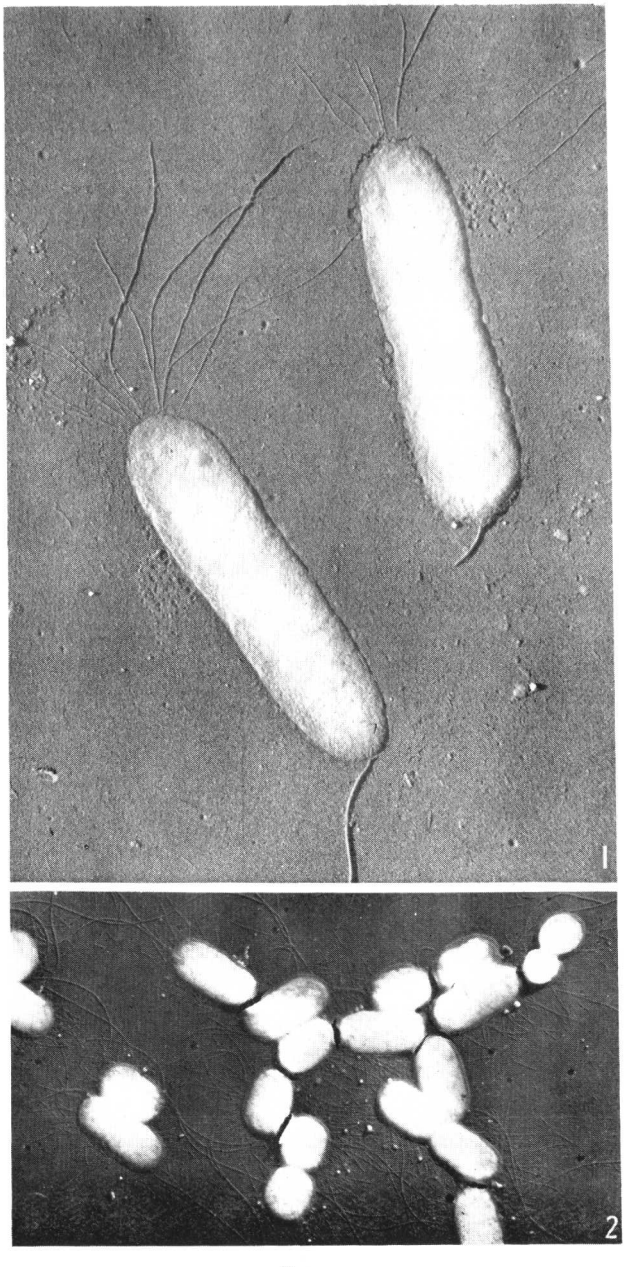

PLATE 4.

Fig. 1. Shadowcast electron micrograph of *Pseudomonas pyocyanea*, showing a flagellum at the upper end and fine threads at the lower. Fig. 2. Shadowcast electron micrograph of *Escherichia coli*, grown on the supporting collodion membrane, showing flagella and a large number of fine threads. E. M. Delft. (A. L. Houwink.)

PLATE 5.

Palladium shadowcast electron micrograph of *Staph. aureus* cell walls. (Dr. I. M. Dawson.)

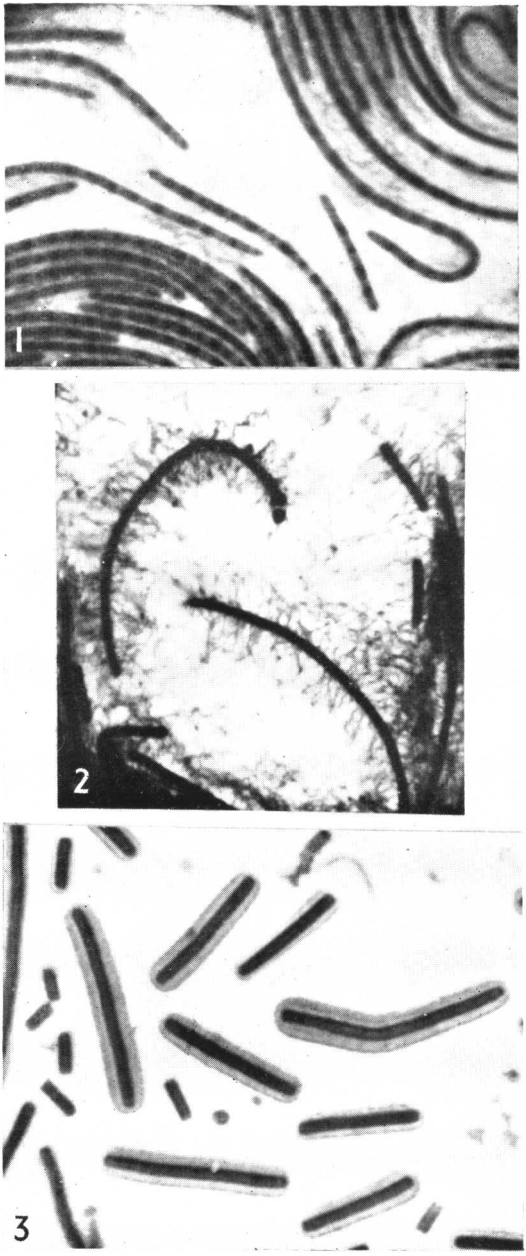

PLATE 6.

Fig. 1. Swarming *Proteus vulgaris*, fixed and stained for cytoplasm. The dark parts of the bacilli represent the cytoplasmic portions. Fig. 2. Swarming *Proteus vulgaris*, treated as the preparation used for fig. 1, with the only exception that the staining process was much extended. Fig. 3. *Bacillus anthracis*, strain H. M., grown on 20–30 per cent horse serum agar, fixed and stained as the preparation represented in fig. 1. (E. Klieneberger-Nobel.)

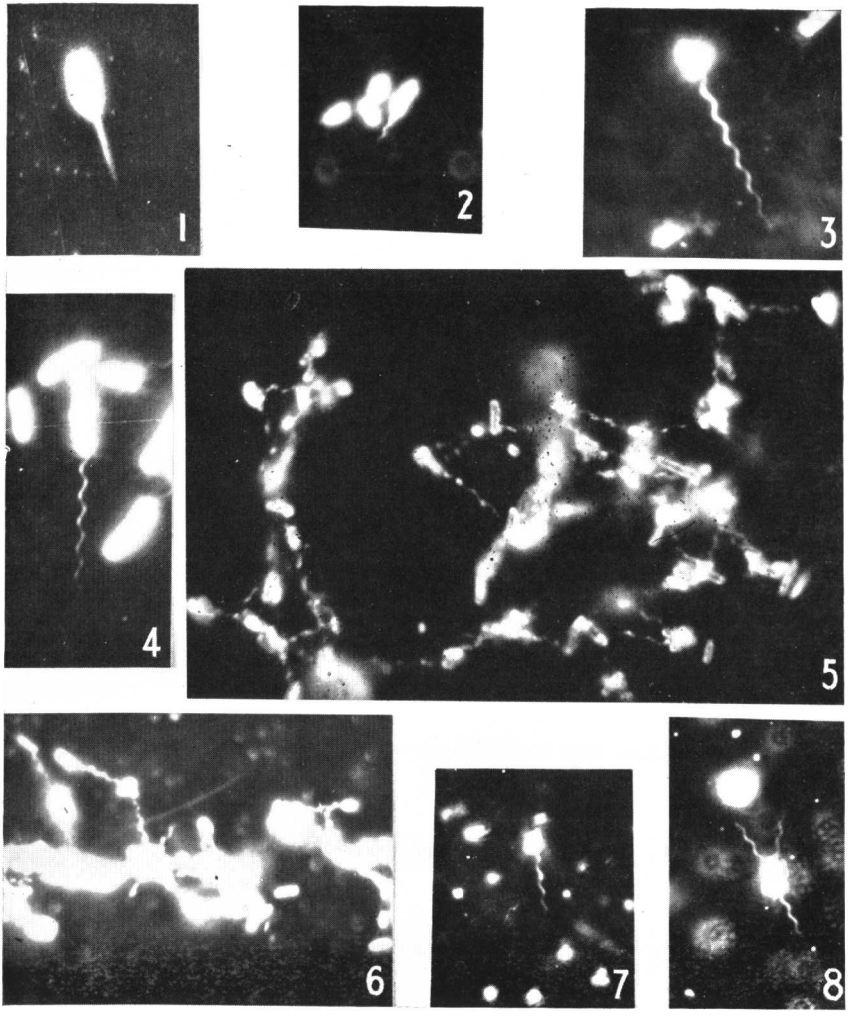

PLATE 7.

Fig. 1. *S. typhi*, in broth, swimming fast, with tail. ×2,860. Fig. 2. *S. typhi*, in broth, slowing down, spiral-like tail. ×955. Fig. 3. *S. typhi*, in gum solution, long thickened tail. ×2,860. Fig. 4. *S. typhi*, in gum solution, coating of tail beginning to break up into granules. ×2,860. Fig. 5. *S. typhi*, in gum solution, coating of tails broken up into granules. ×955. Fig. 6. *S. typhi*, agglutinated by H-serum. Note bacteria linked up by thickened flagella, covering of which is breaking down into granules. ×955. Fig. 7. *B. cereus*, in methylcellulose solution, with thickened tail. ×955. Fig. 8. *B. cereus*, in methylcellulose solution, tail split up into three thickened flagella. ×955. (A. Pijper.)

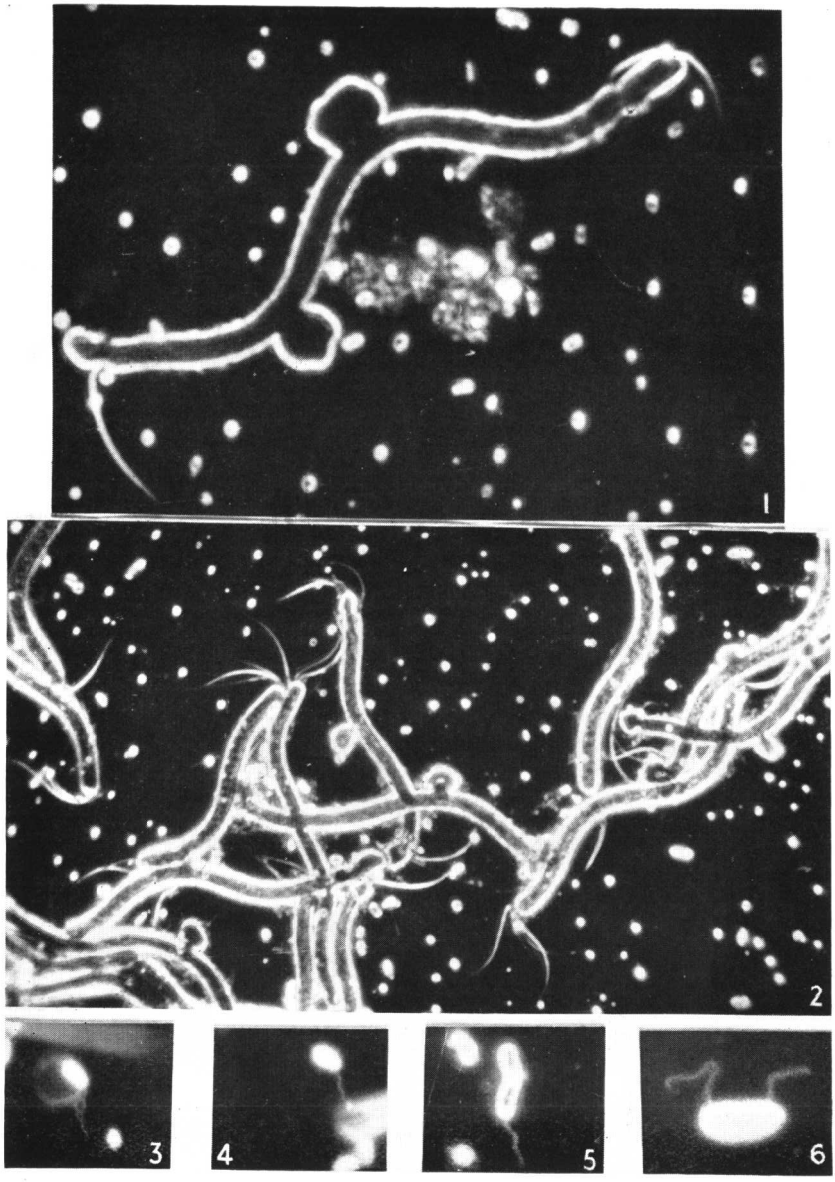

PLATE 8.

Fig. 1. *Sp. volutans*, in water, wall distended by inner pressure, attachment of flagella shifted from pole to side. ×4,000. Fig. 2. *Sp. volutans*, as Fig. 1, but varying degrees of distension and shifting. ×1,800. Fig. 3. *S. typhi*, in broth, tail splitting into two flagella. ×1,000. Fig. 4. *S. typhi*, in broth, swimming slowly, tail on side. ×1,000. Fig. 5. *V. metschnikovii*, in broth, swimming slowly, spiral-like tail. ×1,500. Fig. 6. *S. typhi*, in broth, cell contents being squirted out through two holes in wall. ×3,000. (A. Pijper.)

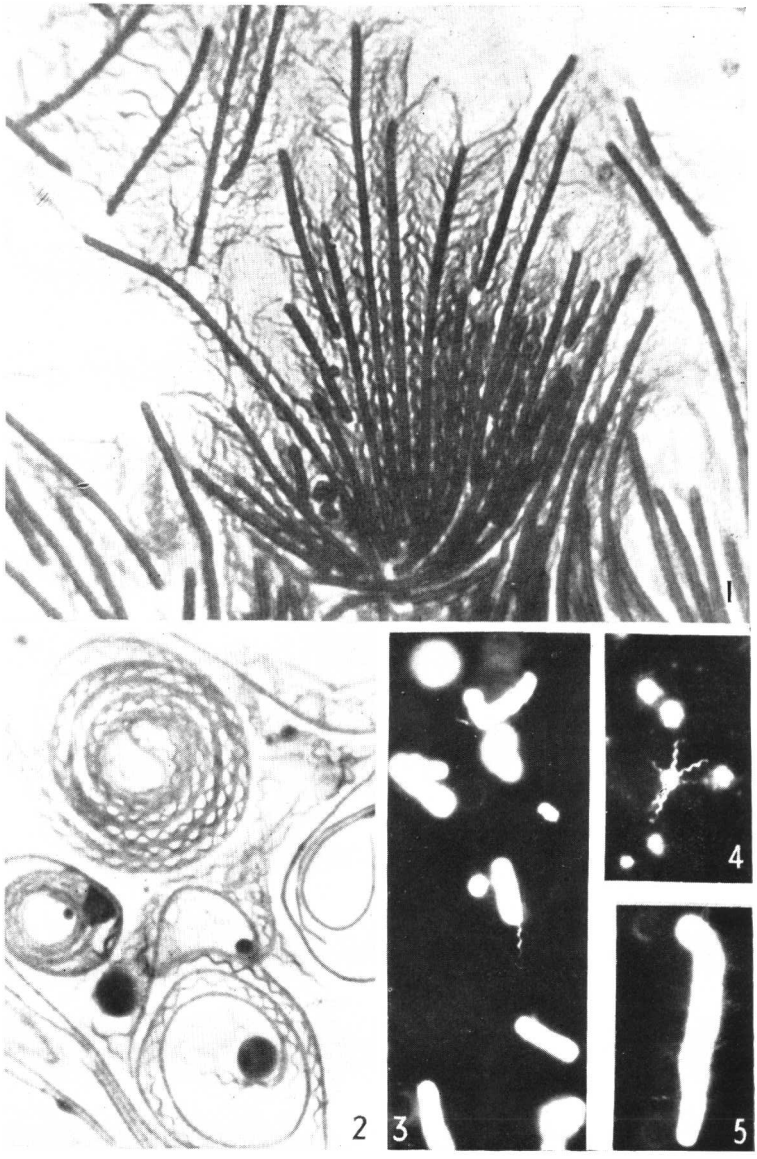

PLATE 9.

Figs. 1 and 2. Stained flagella of *Proteus vulgaris*. Note the thick 'ropes' of flagella where the coils of the bacterial body are close together, and the looser arrangement where they are more widely separated. (A. Fleming and A. Voureka.) Fig. 3. *Caryophanum latum*, rounded stationary segment of filament with spiral coils attached. Fig. 4. *C. latum*, young motile cell with tail. Fig. 5. *C. latum*, cell at rest showing peritrichous 'flagella.' (Figs. 3–4 by D. Erikson.)

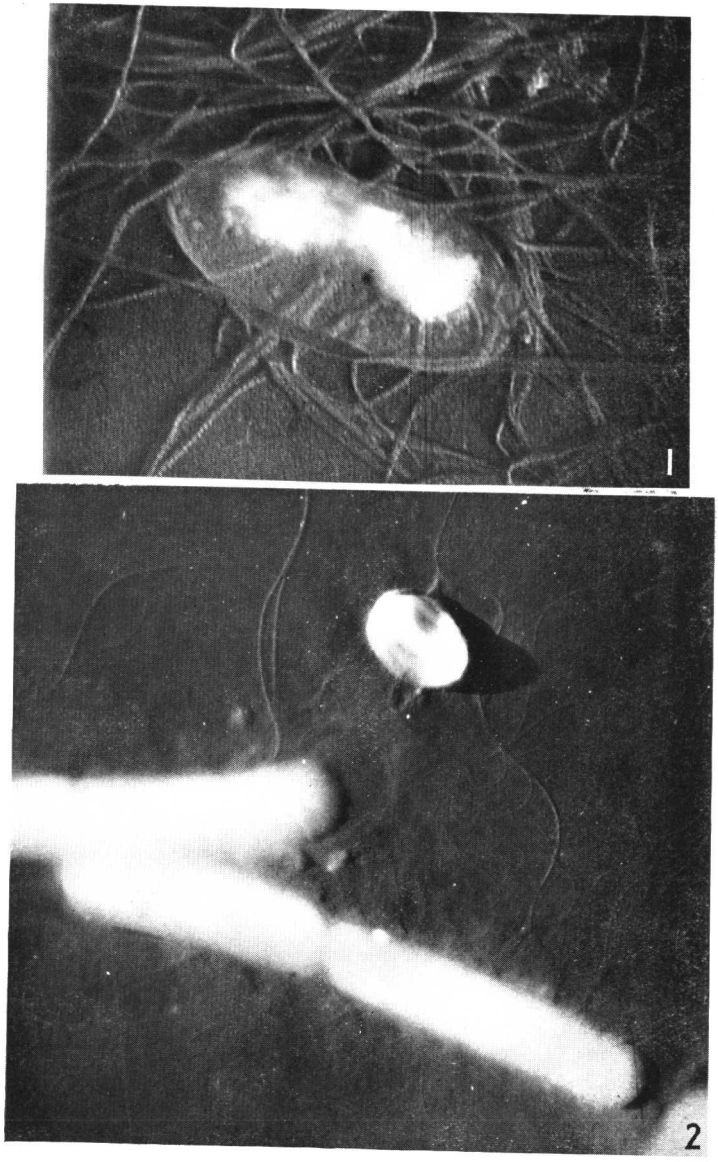

PLATE 10.

Fig. 1. Shadowcast electron micrograph of *Acetobacter xylinum*, showing long fibrils of extra-cellular cellulose. × 24,000. Fig. 2. Shadowcast electron micrograph of *Bacillus mesentericus*. × 12,800. Germinated from spores on a collodion membrane. Photograph taken at Princeton, N.J. (Dr. W. van Iterson.)

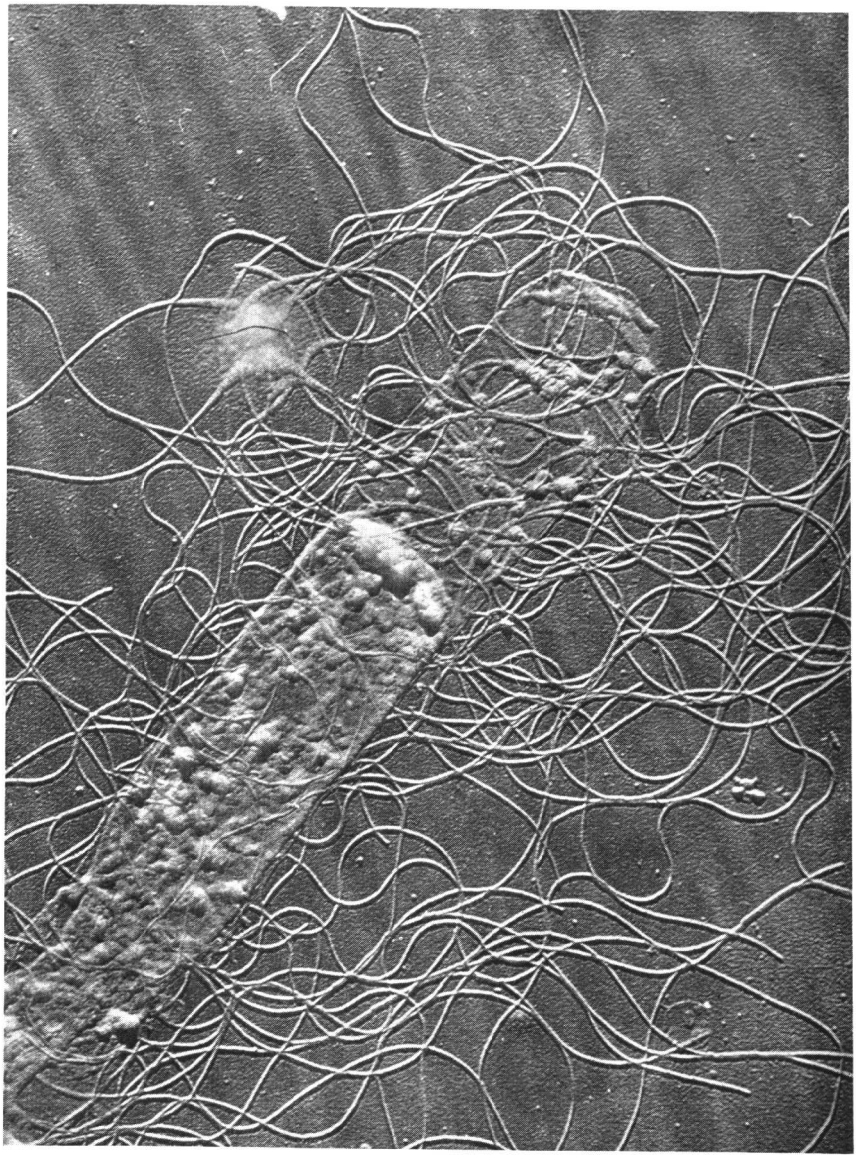

PLATE 11.

Shadowcast electron micrograph of *Proteus vulgaris*. Cell is partly autolysed. ×23,860. Prepared in collaboration with Dr. C. F. Robinow. (Dr. W. van Iterson.)

(By permission of *Biochimica et Biophysica Acta*.)

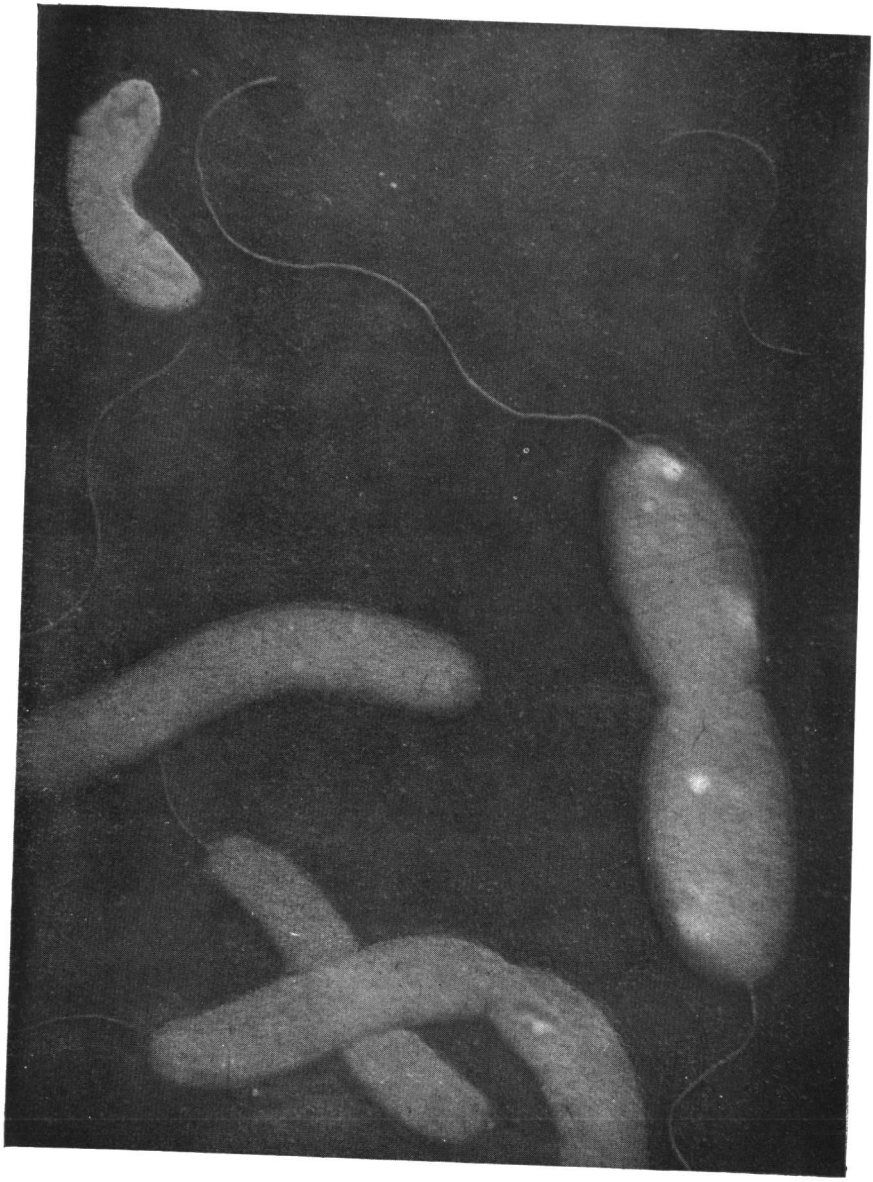

PLATE 12.

Shadowcast electron micrograph of *Vibrio metchnikovii*, showing an apparent connection of the polar flagellum with the protoplast. ×13,330. (Dr. W. van Iterson.)

CONTENTS

PAGE

I. INTRODUCTION. N. W. Pirie 1

II. THE SURFACE STRUCTURE OF *Shigella shigæ* AS REVEALED BY ANTIGENIC ANALYSIS. W. T. J. Morgan 9

Discussion by M. Stacey, C. M. Chu, C. P. Stewart, P. Mitchell, E. Klieneberger-Nobel, A. Felix

III. THE NATURE OF THE SURFACE OF GRAM-POSITIVE BACTERIA. M. Stacey 29

Discussion by H. Taylor, K. A. Bisset, J. R. Marrack

IV. THE OSMOTIC BARRIER IN BACTERIA. P. Mitchell . 55

Discussion by K. A. Bisset

V. ON THE MECHANISM OF ADSORPTION OF BACTERIOPHAGES ON HOST CELLS. T. F. Anderson . . 76

Discussion by A. Felix, A. L. Houwink, D. Herbert, M. Stacey, A. Pirie

VI. THE STATUS OF SOME ARGUMENTS ABOUT THE BACTERIAL SURFACE. A. A. Miles . . . 96

VII. THE NATURE OF BACTERIAL SURFACES. E. T. C. Spooner 106

Discussion by J. Smiles, I. M. Dawson, D. McClean, H. Taylor

VIII. CAPSULE FORMATION IN THE PNEUMOCOCCUS. Harriett Taylor 123

Discussion by A. W. Downie, M. R. Pollock, M. Stacey, E. Klieneberger-Nobel, D. McClean

IX. BACTERIAL SURFACE, FLAGELLA AND MOTILITY. A. PIJPER 144

Discussion by T. Y. Kingma Boltjes, A. Fleming, A. L. Houwink, Woutera van Iterson, Dagny Erikson